The Claims

What is claimed is:

1. A fiber optic switching module comprising:

a first and a second group of optical fiber receptacles which are separated from each other at opposite ends of a free space optical path, and each of which groups is respectively adapted for receiving and fixing ends of optical fibers;

lenses juxtaposed with ends of optical fibers fixed respectively at the first and second groups and disposed along the optical path between groups, each of said lenses being respectively disposed with respect to an end of an associated optical fiber of the first or second group so that a beams of light as may be emitted from the end of the optical fiber pass through said immediately adjacent lens to propagate as a quasi-collimated beams through the optical path from said lens toward said second or first group of optical fiber receptacles;

a first and a second sets of reflective light beam deflectors that are both disposed along the optical path between the groups of optical fiber receptacles, each of said sets of light beam deflectors being associated with one of the groups of optical fiber receptacles and having a number of light beam deflectors that equals the optical fibers in the group with which it is associated, each of the light beam deflectors in said first or said second set:

being associated with one of the optical fibers in the associated group of optical fiber receptacles;

being located along the optical path so the quasi-collimated beam of light as may be emitted from the lens associated with the optical fiber impinges upon the light beam deflector to be reflected therefrom through the optical path; and

being energizable by drive signals supplied to said fiber optic switching module to be oriented for reflecting the quasi-collimated beam of light as may be emitted from the associated optical fiber to also reflect off a selected one of the light beam deflectors in said second or said first set;

whereby a pair of light beam deflectors, one light beam deflector of the pair belonging to the first set and one belonging to the second set, may be selected and oriented by the drive signals supplied thereto to couple a quasi-collimated beam of light propagating through the optical path from the end of one optical fiber as may be fixed in the optical fiber receptacle either of the first or of the second group to reflect sequentially off the pair of energized light beam deflectors into a selected one of the optical fiber receptacles so as to enter an optical fiber as may be fixed at the second or at the first group of optical fiber receptacles.

2. The fiber optic switching module of claim 1 wherein the first group of optical fiber receptacles is located at a side A of the fiber optic switching module, and the second group of optical fiber receptacles is located at a side B of the fiber optic switching module, side A being spaced apart from side B; and wherein the first and second sets of light beam deflectors are also spaced apart from each other.

3. The fiber optic switching module of claim 2 wherein the optical path between side A and side B is C-shaped.

4. The fiber optic switching module of claim 2 wherein the optical path between side A and side B is Z-shaped.

5. The fiber optic switching module of claim 2 wherein the optical path between side A and side B is W-shaped.

6. The fiber optic switching module of claim 2 wherein to fold the optical path between said sets of light beam deflectors a mirror is disposed therebetween.

7. The fiber optic switching module of claim 1 wherein to fold the optical path between said sets of light beam deflectors a mirror is disposed therebetween.

8. The fiber optic switching module of claim 1 wherein the first group includes only one optical fiber receptacle and the second group includes the remaining optical fiber receptacles whereby the fiber optic switching module couples a beam of light from the end of an optical fiber as may be fixed in the one optical fiber receptacle to the end of any optical fiber as may be fixed in the second group of optical fiber receptacles.

9. The fiber optic switching module of claim 1 wherein lenses included in the fiber optic switching module have faces that are oriented at an oblique angle with respect to a longitudinal axis of each lens so beams of light from ends of optical fiber as may be fixed in the optical fiber receptacles emitted at an angle with respect to a center line of the optical fiber become aligned with the longitudinal axis of the lens.

10. The fiber optic switching module of claim 1 wherein lenses included in the fiber optic switching module are formed with a smaller diameter outer surface which is disposed nearer to an end of an optical fiber as may be fixed in one of the optical fiber receptacles, the lenses also being formed with a larger diameter outer surface which is disposed further from an end of an optical fiber as may be fixed in one of the optical fiber receptacles than the smaller diameter outer surface of the lens.

11. The fiber optic switching module of claim 1 wherein individual optical fiber receptacles are conically-shaped and are adapted to receive an individual, mating, conically-shaped optical fiber collimator assembly which carries the lens that is associated with an optical fiber as may be fixed in the optical fiber receptacle, the optical fiber collimator assembly also being adapted for receiving and fixing an end of an optical fiber therein.

12. The fiber optic switching module of claim 11 further comprising environmental housing that encloses the optical path through which the beams of light propagate.

13. The fiber optic switching module of claim 12 wherein the environmental housing provides temperature regulation for maintaining a stable operating environment for the fiber optic switching module.

14. The fiber optic switching module of claim 12 wherein dry gas flows through the environmental housing to hinder moisture from condensing within the fiber optic switching module.

15. The fiber optic switching module of claim 12 wherein the environmental housing is pressurized to exclude atmosphere surrounding the environmental housing from entering the fiber optic switching module.

16. The fiber optic switching module of claim 12 wherein the environmental housing includes a nonsaturable microdryer to hinder moisture from condensing within the fiber optic switching module.

17. The fiber optic switching module of claim 12 wherein a wall of the environmental housing is pierced by an electrical feed-through through which the drive signals pass.

18. A fiber optic switch comprising:

a fiber optic switching module that receives and fixes ends of optical fibers, and that includes a plurality of reflective light beam deflectors which may be selected as pairs to be oriented responsive to drive signals supplied to said fiber optic switching module for coupling a beam of light between a pair of optical fibers fixed in said fiber optic switching module, said fiber optic switching module also producing orientation signals from each light beam deflector which indicate orientation thereof; and

at least one portcard that supplies the drive signals to said fiber optic switching module for orienting at least one light beam deflector included therein, and which receives the orientation signals produced by that light beam deflector, said

portcard also receiving data which specify an orientation for the light beam deflector, comparing those received data with the orientation signals received from the light beam deflector, and adjusting the drive signals supplied to said fiber optic switching module to reduce any difference between the received data and the orientation signals.

19. A portcard adapted for use in a fiber optic switch that includes an fiber optic switching module that receives and fixes ends of optical fibers, and that includes a plurality of reflective light beam deflectors which may be selected as pairs to be oriented responsive to drive signals supplied to said fiber optic switching module for coupling a beam of light between a pair of optical fibers fixed in said fiber optic switching module, said fiber optic switching module also producing orientation signals from each light beam deflector which indicate orientation thereof, the portcard comprising:

a driver circuit for supplying the drive signals to said fiber optic switching module for orienting at least one light beam deflector included therein; and

a dual axis servo that receives data which specify an orientation for the light beam deflector, and also receives the orientation signals produced by that light beam deflector, the portcard comparing the data with the orientation signals received from the light beam deflector, and adjusting the drive signals supplied to said fiber optic switching module to reduce any difference between the received data and the orientation signals.

20. The portcard of claim 19 wherein said driver circuit supplies electrostatic drive signals to said fiber optic switching module.

add 37